Manual

Oxygen module
FCX-MLxx-CH

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Output protocol

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2 Customer Service

We at PEWATRON AG would like to offer the best possible customer service. Should you have any questions, problems or comments regarding your FCX-MLxx-CH, we would appreciate if you get in touch with us.
We recommend that all services, including repairs of the device, will only be taken care of by either our customer service or by specially trained staff.

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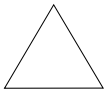
3 Security Information

Safety hazards that can endanger humans or do damage to the devices are specially mentioned in the user manual.
Before installing the device you should read the instructions carefully. Please take note of all paragraphs that point out possible hazards.
Warnings and instructions are expressed as followed:

Warning

Means that ignoring this instruction can endanger humans



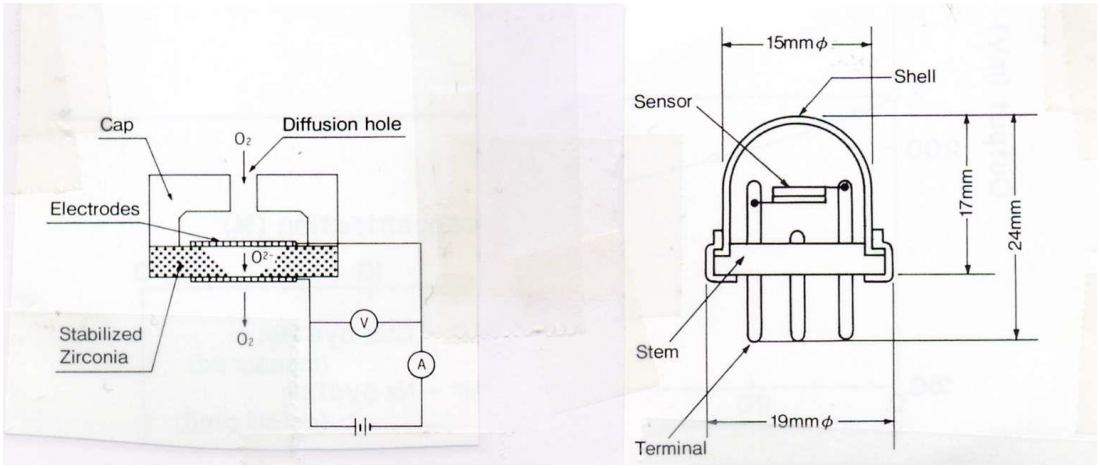
Attention

Means that this instruction has to be followed in order to prevent damage to the device

4 Measuring Principle

The sensor module is a complete solution for measuring oxygen within the range of 0,1...25%. The sensor and the electronics are united on one board. The electronic amplifies the sensor signal and puts it out as logarithmic current output signal 4…20mA (according IEC 60381)

Principle sketch of the O_2 Limiting-current sensor



The zirconia is pervious to oxygen ions when heated up to approx. 450°C. Therefore the oxygen gets pumped out off a cavity by a current attached to the sensor. During a constant gas pressure the amount of pumped-off oxygen equals the amount of the through the capillaries post-defunded oxygen molecules and within a certain range independent of the current attached between the electrodes. The measure current is proportional to the amount of the pumped-off oxygen molecules. The link between oxygen partial pressure and sensor current is according to the following formula:

$$I_s = c\ I_n\ (1 - pO_2 / pt)$$

means:

I_s = sensor current
c = constant (sensor specific)
pO_2 = oxygen partial pressure
pt = gas pressure (total)

The sensor module takes care of two jobs:

- The link between oxygen partial pressure and sensor current
- Regulation of the heating performance of the sensor

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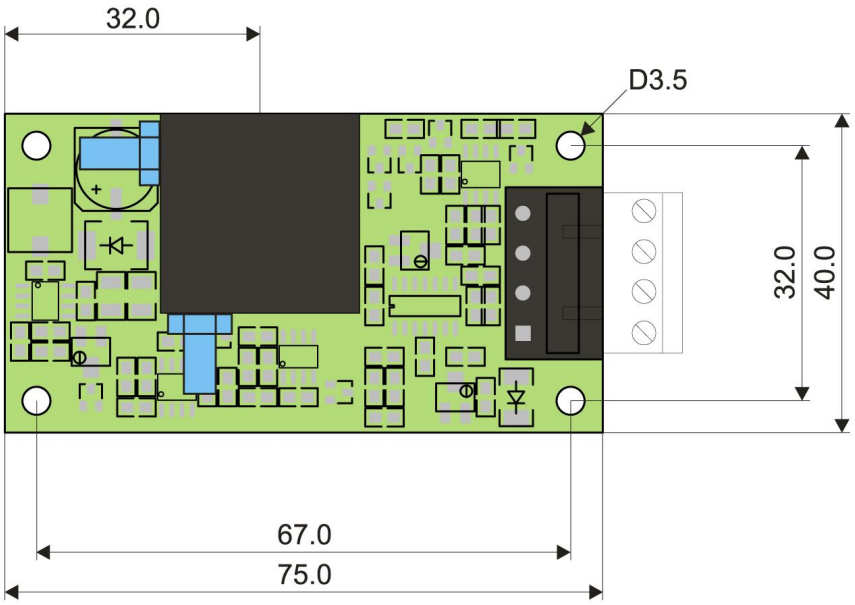
5 Operation Start

5.1 Mechanical Installation

The dimensions of the board are 75 x 40 x 28mm.
On every corner are mounting wholes with a diameter of 3,5 mm.



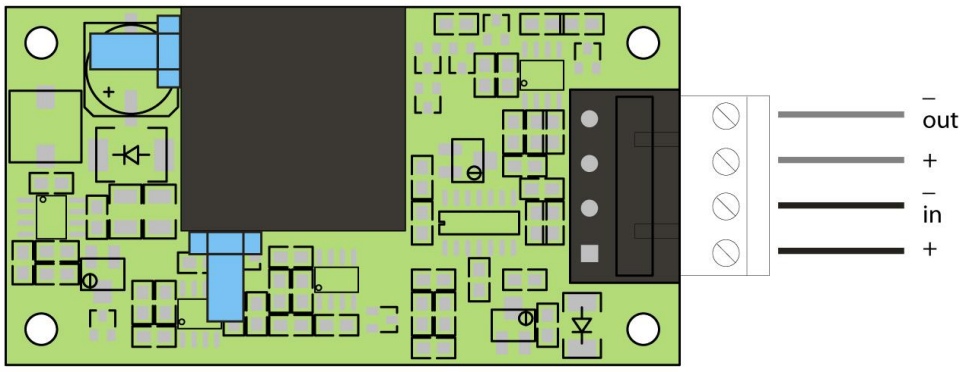
Attention	The board holds highly sensitive switches. While installing make sure that no components get damaged mechanically

5.2 Pneumatical Connections

The flow housing has two pressure ports with 5mm diameter. The direction of the flow isn't important.

Attention	**Do never use silicone tubes.**

5.3 Electrical Connections



5.3.1 Supply

The module gets supplied with 7...28VDC through the clamps 1 (+) and 2 (-), approx. 200mA (24VDC).

5.3.2 Analog Output

For the output signal the clamps 3 (+) and 4 (-) can be used.

6 Environment Condition

Also see item 11 in our specifications, especially for the temperature and humidity range (non-condensing).

- Not to be operated out doors.
- Protect against humidity

The temperature of the sensor is 450°C. Be aware of possible dangers while handling sensitive gas mixtures.

Warning

Potentially explosive Atmosphere
The device mustn't be opened in a potentially explosive atmosphere.

7 Warm Up Time

The modules need a warm up time of approx. 3 minutes

8 Gas Flow

Heed the following points:

- The flow should not be smaller than 0,1 and not larger than 3,0l/min. Optimal 0,5l/min
- We recommend to use a suitable filter, since the gas flow can contaminate the sensor, which will shorten its life span considerably.
- Avoid condensation (H_2O) inside the sensor housing.

9 Calibration

All necessary adjustments and calibrations are being done at the production site.
The output signal is to be read as followed:

4...20mA Output (mA) = -57 x ln (1- pO_2 [%]/100) + 4

means:

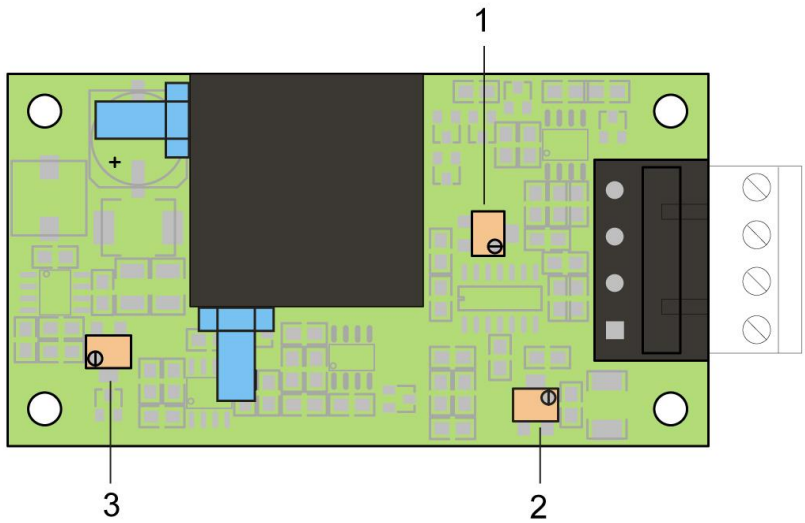
pO_2: oxygen partial pressure in % of the total pressure
I_{out}: output current in mA

9.1 Calibration Adjustments

It is recommended to check the device periodically by running it under regular lab conditions and flush the sensor with regular air (20,95% O_2).

9.2 Adjustment Span and Zero

The modules are calibrated and each module is supplied with a calibration sheet. The result of the measuring at an environmental temperature of 25°C should be 20,95% O_2 ±0,1% O_2. Should there be higher differences as expected try following procedure.



1 Attach the module to the supply

2 Use the sensor in regular air (20,9% O_2)

3 After 10min. adjust the output signal using the potentiometer 2. In a clean environment the amplifier should have an output signal of 17,44mA (±0,05mA).

4 Flow pure N_2.

5 After approx. ca. 10min. adjust the output signal to 4,050mA ±0,005mA using the potentiometer 1.

Achtung

The potentiometers on the boards mustn't be tempered with.

This completes the calibration.

9.3 Adjustment if the sensor needs replacing

1. Attach the module to the supply

2. After approx. 10 minutes adjust the sensor heating (VH) at PIN 4 and 5 using the potentiometer 3. Please note that the VH differs from sensor to sensor and has to be adjusted at an accuracy of ±0,005V. The corresponding values can be found on the attached calibration sheet.

3. Use the sensor in regular air (20,9% O_2)

4. After 10min. adjust the output signal using the potentiometer 2. In a clean environment the amplifier should have an output signal of 17,44mA (±0,05mA).

5. Flow pure N_2.

6. After approx. ca. 10min. adjust the output signal to 4,050mA ±0,005mA using the potentiometer 1.

This completes the calibration.

10 Important Advice

10.1 Restrictions

1 Don't separate the sensor from the circuit board.

2 Don't change the length of the lead wires.

3 Don't operate this sensor in a high oxygen concentration (>25% O_2)
If the sensor is exposed to such high oxygen concentration, limited output over 20mA will be observed. Should this happen, please turn off the power source.

4 Please use regulated DC power source with current capacity over 1 ampere/pc. If current capacity is not sufficient, the sensor module will not operate correctly.

5 This sensor module was adjusted for O_2-N_2 system, so abnormal output maybe observed if there are other gases present.

6 Don't use in a gas that contains the halogen atoms (F, Cl, Br) such as the flon gas. The sensor will be damaged by decomposition of the flon gas.

7 SO_x, NO_x und H_2S will damage the performance of the sensor. Therefore, please do not use sensor module in the atmosphere that contains these gases.

11 Specifications

Measurement Ranges	: 0,1...25% O_2
Supply	: 24VDC nominally (7...28VDC)
Current supply	: typ. 200mA (24VDC). Turn off peak approx. 0,7A
Power Consumption	: 3W
Output	: adjustable 4...20mA
Accuracy	: ±1%FS
Stability	: ±0,5%FS/Year
Repeatability	: ±1% Reading
Temperature Influence	: measuring faults [in % pO_2] ~ pO_2[% x (T_e[°C] – 25°C) / 500 T_e = environmental temperature of the sensors
Response Time	: <30 sec. T_{90}
Gas Temperature	: -10...+50°C
Environment Temperature	: -20...+70°C
Humidity	: 98% r.h. non condensing
Dimensions L x W x H	: 75 x 40 x 28mm
Weight	: 100g

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